FR20DxIR

RedLink® Fiber Optic Receiver for Direct High Voltage Switching

Datasheet

DESCRIPTION

Firecomms FR20DxIR RedLink® receiver is based on a fully integrated photodiode with TIA, limiting amplifier and a MOSFET open drain output to handle switching of voltages in the range from 3 to 20 V (e.g., 3.3, 5, 12, 15 V). The part also includes an optional 1 kΩ Pull-Up resistor R_L.

Housed in non-conducting plastic the RedLink® receiver connector is blue. The housings are compatible with the Versatile Link style of fibre plug and are optimised for use with Plastic Optic Fibre (POF).

The receiver operates over the industrial temperature range of -40 °C to +85 °C supporting many industrial applications where reliable command and control response is required in electrically harsh environments.

The receiver is typically used at low switching speeds where 12 V and 15 V power electronic devices are being switched at kHz speeds.

FEATURES

- MOSFET output stage typically used to directly switch 12 V and 15 V thyristor gate devices.
- Optimised for data rates from DC to 5 MBd
- Industrial temperature range -40 °C to 85 °C
- Flame retardant (UL 94 V-0) connector housings
- Fully integrated photodiode, TIA and limiting amplifier in a single IC
- 5 V TTL/CMOS compatible I/O for ease of design
- Integrated 1 kΩ Pull-Up resistor to Vcc (R_L)
- Low pulse width distortion
- Horizontal, Vertical and 30° Tilted options
- Compatible with Versatile Link cables and connectors

AVAILABLE OPTIONS

Table 1
ORDERING INFORMATION / PART NUMBERS

5 MBd Horizontal Package Inverting, TTL	FR20DHIR
5 MBd Vertical Package Inverting, TTL	FR20DVIR
5 MBd Tilted Package Inverting, TTL	FR20DWIR

APPLICATIONS

Table 2
APPLICATIONS

Application	Switching of 20 V, 18 V, 15 V and 12 V thyristor gate drivers. SCR and IGBT Direct switching
Distance	50 meters Step Index (SI) POF in typical operating conditions 30 meters in worst case conditions
Speed	DC to 5 MBd (depending on series resistance and load capacitance)

SPECIFICATIONS

Table 3
RECEIVER PIN DESCRIPTION

Pin	Name	Symbol
1	RECEIVER OUTPUT	V_0
2	RECEIVER GROUND	GND
3	RECEIVER VCC	V_{cc}
4	R_L PULL-UP RESISTOR	R_L
5	RETAINING PIN	GND
8	RETAINING PIN	GND
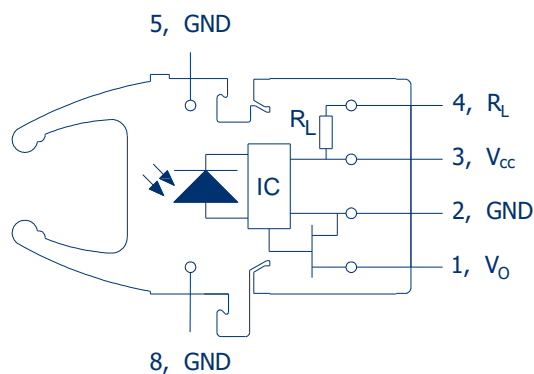
FIGURE 1
Receiver pin-out, top view

Table 4
REGULATORY COMPLIANCE

Parameter	Symbol	Standard	Level
Electrostatic Discharge, Human Body Model (contact ESD)	HBM	Mil-STD-883	Level 2 (4 kV)
UL Certification	UL	60950-1	Files No. E362227
Storage Compliance	MSL	J-STD-020	2a (4-week floor life)
Restriction of Hazardous Substances Directive	RoHS	Directive 2011/65/EU Incl. Amendment 2015/863	Certified compliant

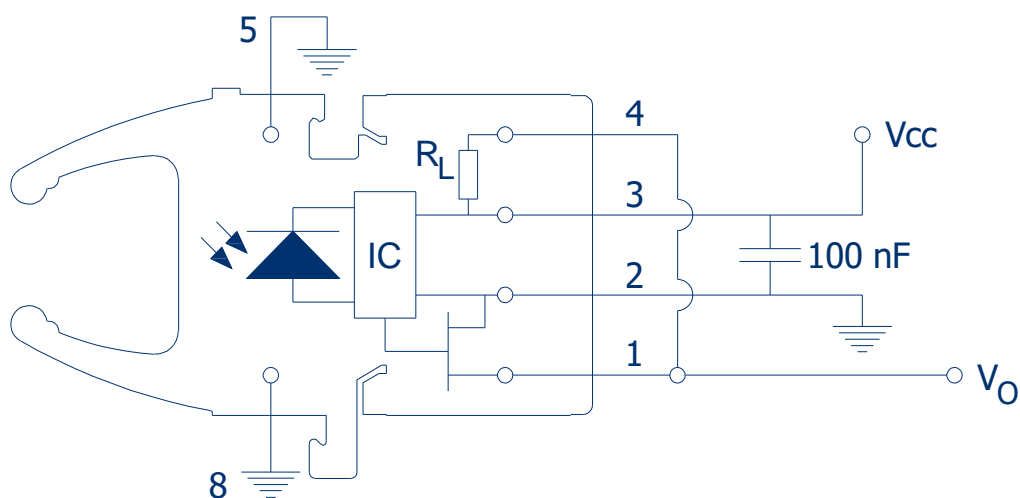## RECOMMENDED APPLICATION CIRCUITS

FIGURE 2
RedLink® Receiver standard 5 V and or 3.3 V operation using R_L Pull-Up resistor.
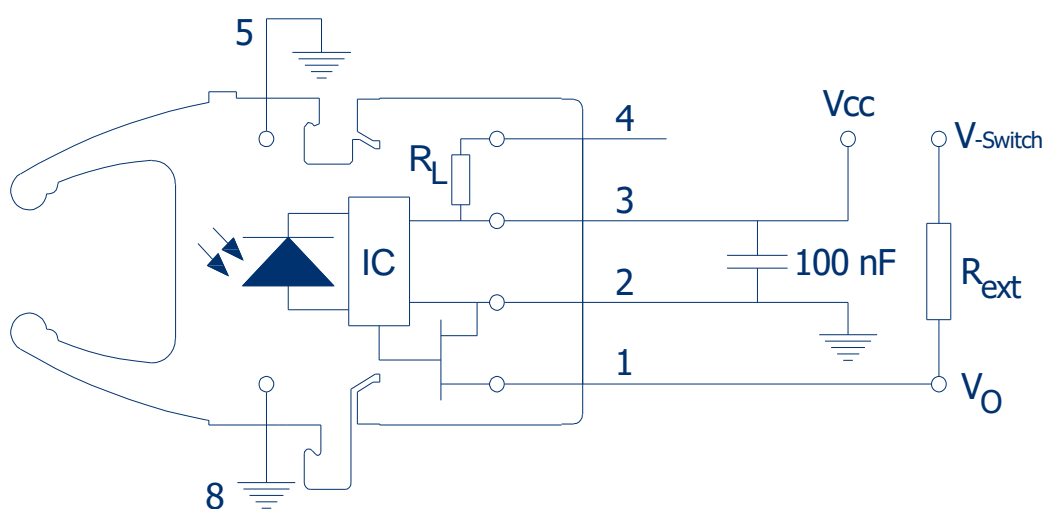**NOTE:** R_L can only be connected to Vo when the maximum value at Vo ≤ Vcc

FIGURE 3
RedLink® Receiver interface circuit for High Voltage (up to 20 V) switching. Vcc can be 5 or 3.3 V. V-Switch is often used to switch for example 12 V and 15 V thyristor gates devices.
NOTE: if V-switch > Vcc then RL should not be connected to Vo.

SPECIFICATIONS

Table 5
ABSOLUTE MAXIMUM RATINGS

These are the absolute maximum ratings at or beyond which the FOT can be expected to be damaged. These ratings are stress ratings only.

Notes:

1. *260 °C for 10 seconds, one time only, at least 2.2 mm away from lead root*
2. *Applying conditions above absolute maximum ratings is destructive to the device. Functional operation of the device at conditions between maximum operating conditions (5.5 V) and absolute maximum ratings is not implied. Extended exposure to stresses above recommended operating conditions will have an effect on device reliability.*
3. *The R_L pin can only be used when the maximum value of V_O does not exceed the maximum operating condition V_{CC}. The maximum operating condition V_{CC} is 5.5 V. For example, if V_O switches between 0 and 5 V and V_{CC} is equal to 5 V then R_L can be connected to V_O. However, if V_{CC} is 3.3 V and V_O switches between 0 and 5 V then R_L cannot be connected to V_O.*
4. *V_{Switch} is the External Power Supply for the external Pull-Up resistor R_{ext}. The maximum allowed voltage that can be switched is 20 V. .*

| Parameter	Symbol	Minimum	Maximum	Unit
Storage Temperature	T_{stg}	-40	+85	°C
Operating Temperature	T_{op}	-40	+85	°C
Soldering Temperature [1]	T_{sld}		+260	°C
Supply Voltage [2]	Vcc	-0.5	+7	V
Rx Output Current (maximum drain source current)	I_{FDC}		±25	mA
Storage Compliance	MSL		2a	J-STD-020
Maximum Output Power	P_{OD}		40	mW
R_L Pull-up Voltage [3]	V_{RL}	-0.5	Vcc	
Output Voltage	Vo	-0.5	20	V
External V_{Switch} Power Supply [4]	V_{Switch}	-0.5	20	V
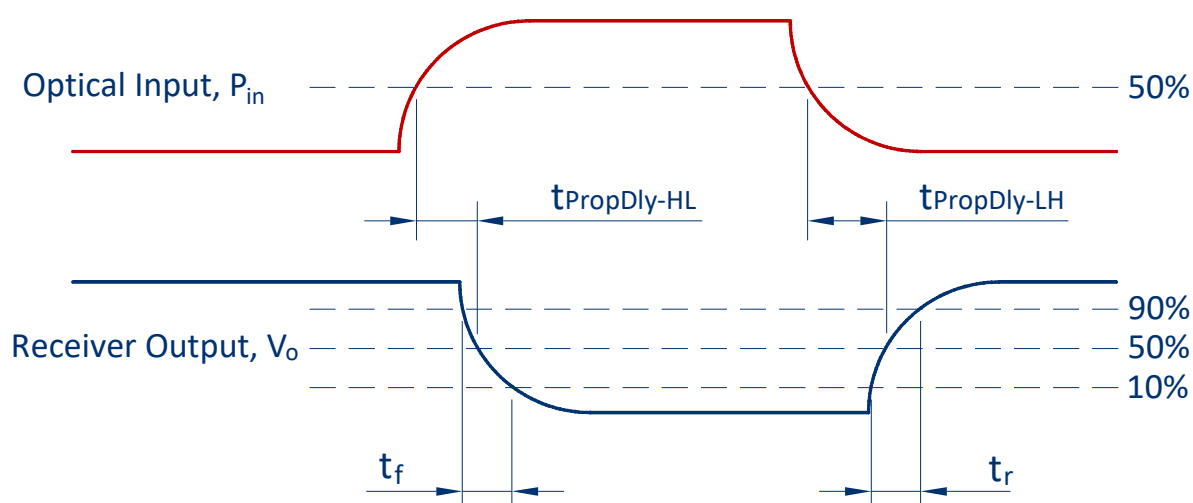
FIGURE 4
Receiver propagation delay and rise/fall time definitions

SPECIFICATIONS

Table 6
RECEIVER ELECTRICAL AND OPTICAL CHARACTERISTICS

Test Conditions:
1. *Wake up Delay is the delay from when Vcc > 2.75 V to when the output will respond correctly to Optical Input.*
2. *Test data was validated using a transmitter with 5 ns rise and fall time, over the full temperature range of -40 °C to +85 °C, and over the full supply rail voltage options of 5 V and 3.3 V ± 10% and over the optical received power range P_H to P_L. Input power levels are for peak (not average) optical input levels. For 50% duty cycle data, peak optical power is twice the average optical power. Data referred to as typical are rated at ambient +25 °C.*
3. *Optical signal is delivered over 1mm core, step index, 0.5NA POF.*
4. *Measured in the Interface Circuit for High Voltage, over the Vcc and V-switch range 4.5 V to 5.5 V, Ambient Temperature range -40 °C to 85 °C, Received optical power P_H = -1 to -20 dBm, at 5 Mbps. R_{ext} = 560 Ω, C_L = 22 pF. R_L pin o/c.*
5. *R_L cannot be connected to Vo when Vo is used to switch a voltage greater than Vcc.*

Parameter	Symbol	Min	Typical	Max	Unit	Test Condition
Supply Current	I_{CC}	10.5	13	16	mA	[2,3,4]
Wake Up Delay	$t_{power-on}$		40		μs	[1,2,3,4]
High Level Output Current	I_{OH}		0.5	100	μA	Vo = 20 V, Received Power < P_L maximum
Low Level Output Voltage	V_{OL}		44	75	mV	Io = 25 mA, Received Power > P_H minimum
Optical Power High	P_H	-20		+2	dBm	[2,3]
Optical Power Low	P_L			-40	dBm	[2,3]
Data Rate		DC		5	MBd	Min-UI = 200 ns Max f = 2.5 MHz
Output Rise Time (10% - 90%)	t_r	30	40	50	ns	[2,3,4]
Output Fall Time (90% - 10%)	t_f		3	10	ns	[2,3,4]
Pulse Width Distortion	PWD	-40		40	ns	[2,3,4]
Propagation Delay Low-to-High	$t_{PropDly\_LH}$			80	ns	[2,3,4]
Propagation Delay High-to-Low	$t_{PropDly\_HL}$			65	ns	[2,3,4]
Supply Voltage	V_{CC}	2.97		5.5	V	
External V_{Switch} Power supply	V_{Switch}	2.97		20	V	I_{0-max} = 25 mA
Output Current	I_0			25	mA	Maximum DC value
Internal Pull-Up Resistor to Vcc	R_L	0.7	1	1.5	kΩ	[5]

MECHANICAL DATA, HORIZONTAL

Front View

Side View

Rear View

PCB Hole Details
Top View

Top View

Pin 1 Indicator — Date Code

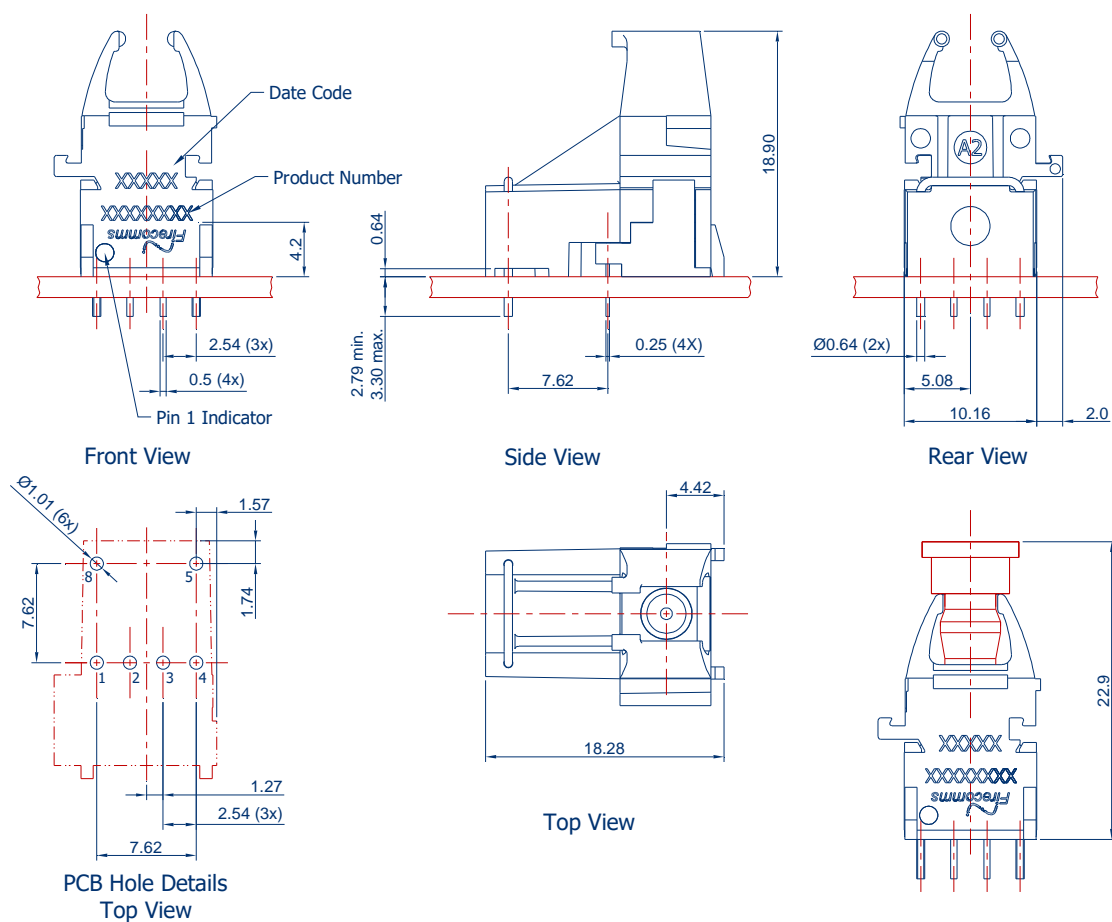Product Number

Dust Cap

FIGURE 5
Mechanical dimensions of RedLink® horizontal connectors and PCB footprint, which is a top view
General dimensional tolerance is ± 0.2 mm

FIGURE 6
Packing tube for Firecomms RedLink® horizontal connectors

MECHANICAL DATA, VERTICAL

Front View

Side View

Rear View

PCB Hole Details
Top View

Top View

FIGURE 7
Mechanical dimensions of RedLink® vertical connectors and PCB footprint, which is a top view
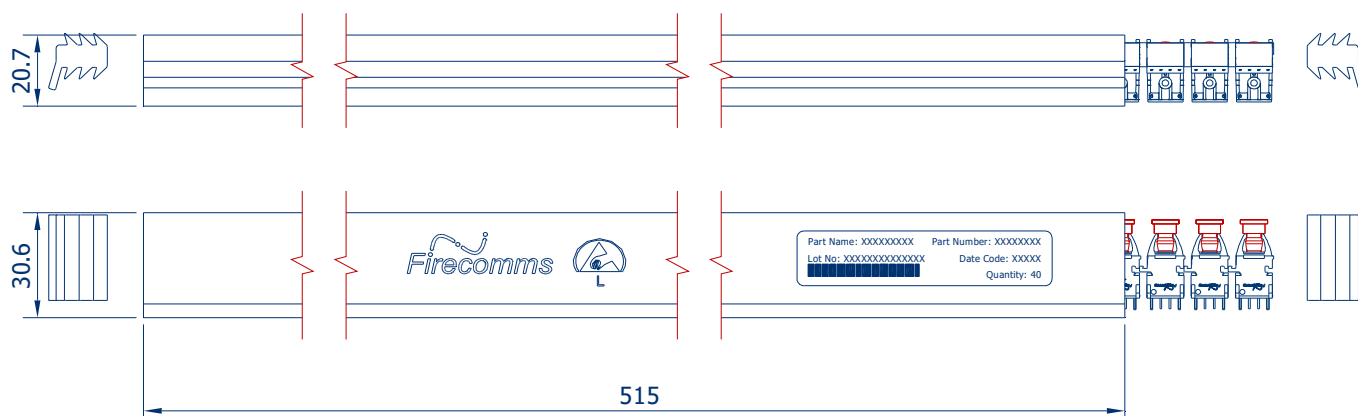**General dimensional tolerance is ± 0.2 mm**

FIGURE 8
Packing tube for Firecomms RedLink® vertical connectors
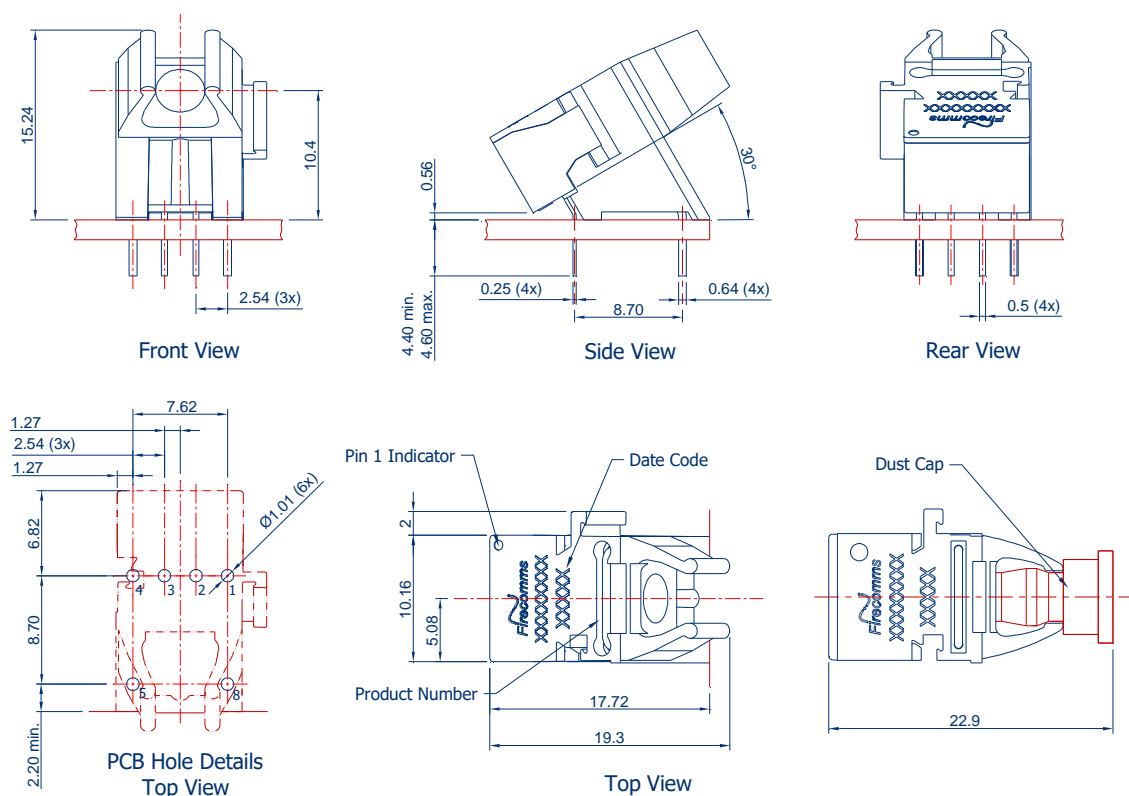
MECHANICAL DATA, 30⁰ TILTED

FIGURE 9
Mechanical dimensions of RedLink® tilted connectors and PCB footprint, which is a top view
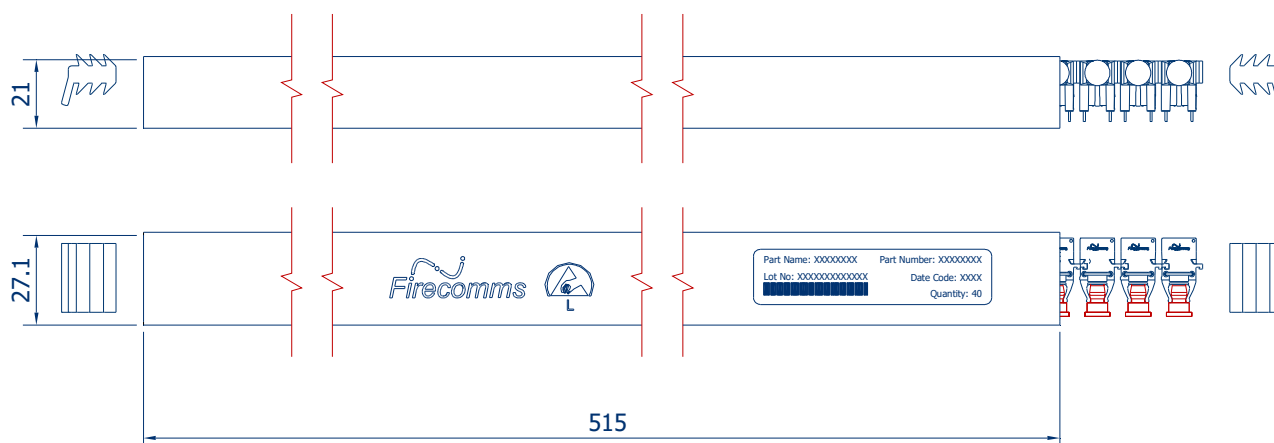**General dimensional tolerance is ± 0.2 mm**

FIGURE 10
Packing tube for Firecomms RedLink® tilted connectors

PART HANDLING

Firecomms RedLink® connectors are auto-insertable and tested for handling in static-controlled assembly processes (Human Body Model - HBM). Cleaning, degreasing and post solder washing should be carried out using standard solutions compatible with both plastics and the environment. For example, recommended solutions for degreasing are alcohols (methyl, isopropyl and isobutyl). Acetone, ethyl acetate, phenol or similar solution-based products are not permitted.

In the soldering process, non-halogenated water-soluble fluxes are recommended. RedLink® connectors are not suitable for use in reflow solder processes (infrared/vapor-phase reflow). The dust plug should remain in place during soldering, washing and drying processes to avoid contamination of the active optical area of each part.

The Moisture Sensitivity Level (MSL) classification of this device is 2a according to JEDEC J-STD-020.
The shelf life of an unopened MBB (Moisture Barrier Bag) is 24 months at < 40 °C and < 90 % R.H.
Once the Moisture Barrier Bag is opened, the devices can be either;
  a) Stored in normal factory conditions < 30 °C and < 60 % R.H. for a maximum of 672 hours
     (4 Weeks) prior to soldering
  b) Stored at < 10 % R.H. (Dry Cabinet)

PACKING INFORMATION

Components are packed in PVC anti-static tubes and in moisture barrier bags. Bags should be opened only in static-controlled locations, and standard procedures should be followed for handling moisture sensitive components.

Table 7
PACKING INFORMATION

		Horizontal	Vertical	Tilted
Components per Tube		40	40	40
	Tube Length	515 mm	515 mm	515 mm
	Tube Height	16.2 mm	20.7 mm	21 mm
	Tube Depth	26.9 mm	30.6 mm	27.1 mm
Tubes per Bag		5	5	5
Bags per Inner Carton		1	1	1
	Inner Carton Length	630 mm	630 mm	630 mm
	Inner Carton Width	70 mm	70 mm	70 mm
	Inner Carton Height	105 mm	105 mm	105 mm
Weight per Inner Carton, Complete		0.77 kg	0.92 kg	0.92 kg
Components per Inner Carton		200	200	200
Inner Cartons per Outer Carton		10	10	10
	Outer Carton Length	650 mm	650 mm	650 mm
	Outer Carton Width	235 mm	235 mm	235 mm
	Outer Carton Height	376 mm	376 mm	376 mm
Weight per Outer Carton, Complete		8.13 kg	9.60 kg	9.60 kg
Components per Outer Carton		2,000	2,000	2,000